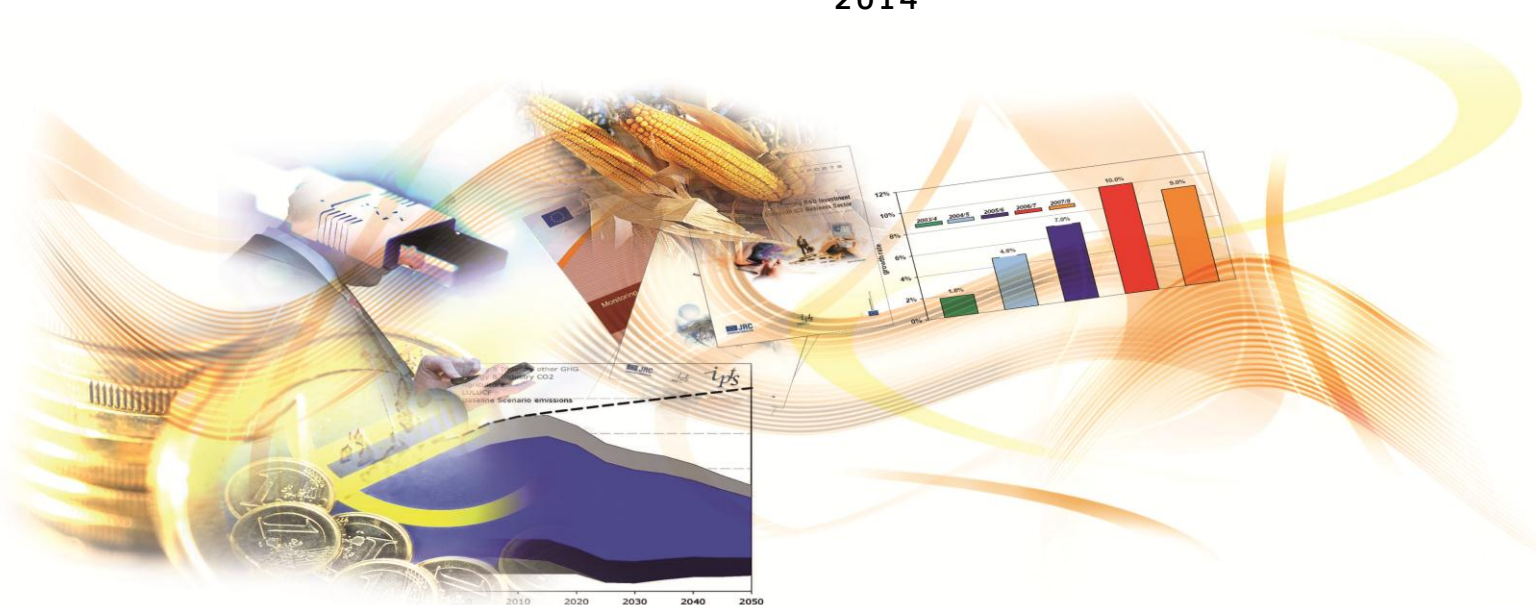


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Abstract

The Analytical Country Reports analyse and assess in a structured manner the evolution of the national policy research and innovation in the perspective of the wider EU strategy and goals, with a particular focus on the performance of the national research and innovation (R&I) system, their broader policy mix and governance. The 2013 edition of the Country Reports highlight national policy and system developments occurring since late 2012 and assess, through dedicated sections:

- national progress in addressing Research and Innovation system challenges;
- national progress in addressing the 5 ERA priorities;
- the progress at Member State level towards achieving the Innovation Union;
- the status and relevant features of Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3);
- as far relevant, country Specific Research and Innovation (R&I) Recommendations.

Detailed annexes in tabular form provide access to country information in a concise and synthetic manner.

The reports were originally produced in December 2013, focusing on policy developments occurring over the preceding twelve months.

ACKNOWLEDGMENTS AND FURTHER INFORMATION

This analytical country report is one of a series of annual ERAWATCH reports produced for EU Member States and Countries Associated to the Seventh Framework Programme for Research of the European Union (FP7). [ERAWATCH](#) is a joint initiative of the European Commission's [Directorate General for Research and Innovation](#) and [Joint Research Centre](#).

The Country Report 2013 builds on and updates the 2012 edition. The report identifies the structural challenges of the national research and innovation system and assesses the match between the national priorities and the structural challenges, highlighting the latest developments, their dynamics and impact in the overall national context.

The first draft of this report was produced in December 2013 and was focused on developments taking place in the previous twelve months. In particular, it has benefitted from the comments and suggestions of Mathieu Doussineau from JRC-IPTS. The contributions and comments from DG-RTD are also gratefully acknowledged.

The report is currently only published in electronic format and is available on the [ERAWATCH website](#). Comments on this report are welcome and should be addressed to jrc-ipts-erawatch-helpdesk@ec.europa.eu.

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EXECUTIVE SUMMARY

The Swiss research and innovation system is of very good quality and shows a distinct organisation, based on a clear separation between the public sector, centred on research intensive universities, and the private sector, centred on the large research units of multinational companies.

Overall, the research intensity measured by gross domestic expenditures on R&D (GERD) was 2.87% in 2008, which is substantially higher than the average in the EU- 27 of about 2%. This high level of expenditures is largely due to the private sector, which covers 74% of the overall investment, while there is a lack of instruments to directly support private R&D, with only 1% of BERD funded directly by the State.

Private research is strongly concentrated in the chemical and pharmaceutical sector and in the (electro) mechanical industry (including precision instruments). The Swiss higher education system consists of ten cantonal universities, two Federal Institutes of Technology and nine Universities of Applied Sciences (UAS) (7 public and 2 private).

In terms of quality and impact of its scientific production, Switzerland holds the second rank in the relative publication and citation index (State Secretariat for Education and Research, 2011a) and has the highest rate of high-quality publications among OECD countries. When the average impact of scientific works is considered, six Swiss universities are among the top 100 in the Leiden ranking 2013. The quality of training is good, as testified by the attractiveness of foreign PhDs and Bachelor students, and the largest graduation rate at doctoral level of all OECD countries, reaching 3.4% in 2009.

Switzerland is one of the most innovative countries in the world and several rankings on innovation point out the quality and marketability of innovation in Switzerland; on the other hand, a great challenge is to get ideas to the market, both for a relatively conservative attitude towards business and risk in Switzerland testified by surveys as well as low levels of seed and start-up venture capital.

The main priority of Swiss research and innovation policies is to provide good framework conditions for research and investments. Research policy is characterised continuity and planning, while for the first time in 2012, the Federal Council devoted one of its guidelines to the Education, Research and Innovation (ERI) system in its Legislative Plan for 2011-2015, clearly stating that Switzerland considers education, research and innovation to be a top priority. Investment is also planned and growing, although the economic stall has produced a slowdown in R&D investment expansion. Between 2008 and 2012 expenditures for education, research and innovation grew by 6.3% annually, whereas the Federal Council goal is of 3.7% per year for the 2013-2016 period. GERD as a share of GDP remained rather stable, from 2.9% in 2004 to 3% in 2009.

R&D funding in Switzerland is competitive and driven by a bottom-up principle in defining the content, while there are few instruments to support private R&D, mostly through project in cooperation with public institutions.

Political responsibilities for research and higher education are divided between the central state (Confederation) and the regional authorities (the Cantons). At the federal level, responsibilities for research and higher education have been integrated from the 1st January 2013, into the State Secretariat for Education and Research and Innovation (SERI) under the Federal Department of Economic Affairs, Education and Research (EAER). The other departments play a very limited role, mainly through departmental research.

The main structural challenges of the Swiss RDI system can be summarised as follows:

- Strong dependency on private-sector investment and of few actors, while the State has little scope to influence the R&D strategies of large companies. This situation entails risks in terms of overspecialization, and that in case the economic prospects faced by these companies

worsen, Switzerland could see challenged its good position in the level of R&D intensity and innovation output.

- While the bottom-up approach and the clear separation between public and private has proven to be very effective, on the other hand there are few policy instruments focusing on thematic priorities, research policy is loosely coupled with the economic one and only targeting small and specific areas of intervention.
- The demand of knowledge intensive workers is not fully met by the educational system, while firms and universities rely on large inflows of foreign researchers. While this is a sign of openness and attractiveness, it also suggests that if these conditions change the system may become vulnerable.

The policy mix is in line with the major needs of the RDI system. Innovation is fostered by knowledge transfer and public-private cooperation, while direct funding firms are mostly absent. The Swiss political system ensures that all relevant stakeholders are included in decision-making. Universities enjoy a relatively high degree of autonomy. Employment conditions for researchers are very good in terms of salaries and attractive of international talents. Partnerships between higher education institutes, research centres and businesses are actively promoted.

Switzerland does not directly adopt the Innovation Union Commitments, given its non-member state status. Hence, some commitments cannot be applied, or see the country in a weaker position, such as regarding the participation to specific initiatives on SME and venture capital. On the other hand, most of the Commitments' principles and areas of intervention have been addressed with rather positive outcomes, such as those on research infrastructures, cooperation with third party countries, open access and smart specialization.

Switzerland is not a member of the EU and thus very few references to ERA policies can be found in Swiss official documents. Nevertheless, Swiss research policy largely complies with the spirit of ERA objectives and the related priorities.

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1 BASIC CHARACTERISATION OF THE RESEARCH AND INNOVATION SYSTEM

In 2012, Switzerland had a population of about 7.95m people corresponding to about 1.6% of the population in the EU-27. Its gross domestic product (GDP) amounted to about €491bn in 2013, yielding a GDP per capita of about €61,900. Research intensity measured by gross domestic expenditures on R&D (GERD) was 2.87% of GDP in 2008, higher than the average of about 2% in the EU-27. The high level of expenditures is largely due to the private sector, which exceeds 2% of GDP. GERD financed by the State amounted to 0.79% of GDP in 2009, above the EU-27 average. GERD financed from abroad amounts to 0.18% of GDP. The higher education sector accounts for nearly all of the public R&D expenditures, which in turn correspond to about 24% of GERD, whereas the private sector accounts for almost 74% of GERD.

The higher education system consists of ten cantonal universities, two Federal Institutes of Technology (FIT) and nine Universities of Applied Sciences (7 public and 2 private). There are four public research institutes within the FIT domain, which nevertheless play a less central role when compared to universities.

High private R&D expenditures are an outcome of the specific structure of the Swiss economy. The manufacturing sector is dominated by the pharmaceutical and machine industries, where about two thirds of BERD are concentrated. Both industries are characterised by the presence of large multinational companies with headquarters in Switzerland. Given the size of these companies and their global strategies, the Swiss State has little direct influence on their research, except for providing good framework conditions.

The Swiss research system is of very good quality both concerning scientific and technological outputs, as shown by international indicators on scientific production (number publications and share of highly cited works) and technological production (patents). With regard to innovation output, Switzerland is ranked among the group of European innovation leaders together with Denmark, Finland, Germany, and Sweden. Switzerland's main strengths are the open and excellent research system, intellectual assets and legal frame. Relative weaknesses can be found in finance and support at seed and start-up stages of innovative entrepreneurship.

The research system displays a rather clear separation between the public sector, centred on very research intensive universities, and the private sector, centred on the large research units of multinational companies. At the same time, cooperation between the public and the private sector is strong in terms of publications (more than 3 times the European average), while projects are supported by the Swiss Innovation Promotion Agency (CTI).

Political responsibilities for research and higher education are divided between the central state (Confederation) and the regional authorities (the Cantons). The Confederation is responsible for the direct funding of research and for the coordination of research activities. The responsibility for higher education is shared between Confederation and Cantons. The Confederation is responsible for the two Federal Institutes of Technology (FITs) in Zurich (ETHZ) and in Lausanne (EPFL). Each Canton are responsible for the universities in its territory, while a national act regulates federal support to these institutions. The Universities of Applied Sciences (UAS) are governed by the Cantons, but under the framework of a national law, which regulates also the financial support by the Confederation.

At the federal level, responsibilities for research and higher education have been integrated from the 1st January 2013, into the Federal Department of Economic Affairs, Education and Research (EAER), and particularly into the State Secretariat for Education and Research and Innovation (SERI). The Federal Office for Professional Education and Technology (OPET) has been attributed to the SERI. The other departments play a limited role, mainly through departmental research, most notable in the energy field, carried out by the Swiss Federal Office of Energy.

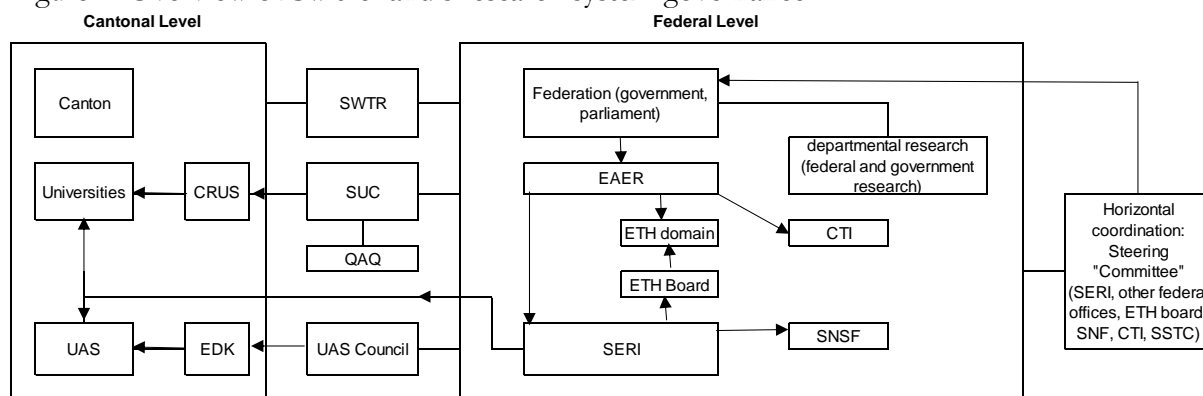
The main duties of the SERI include: the preparation of the four-year strategic plan sent to the Parliament (Federal Council, 2007), support to cantonal universities, funding basic research through the Swiss National Science Foundation (SNSF) and international activities, support to vocational education and the coordination and funding to UAS. In the same department, the Board of the Swiss Federal Institutes of Technology steers the FIT domain, which includes the two FITs and four annex institutes, namely the Paul Scherrer Institute (PSI), the Swiss Federal Institute of Aquatic Science and Technology (EAWAG), the Swiss Federal Laboratories for Materials Science (EMPA), and the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL).

The Swiss University Conference (SUC) is a common body of Cantons and Confederation in charge of the coordination of universities (FITs and cantonal universities). The Conference of Rectors of Swiss Universities (CRUS) is a private association composed by the rectors of the cantonal universities and the presidents of the two FITs. The CRUS is in charge of university planning on behalf of the SUC and manages a number of coordination programs and activities. A similar body exists for UASs, the Swiss Conference of Rectors of Universities of Applied Sciences (UAS-Council).

At the intermediary level, the main actors are the two project funding agencies and an advisory body. The SNSF is a foundation under private law, headed by the SERI and funded by the Confederation, responsible for the support to basic research. Moreover, it manages the national research programs (NRP), as well as a programme aiming to create “National Centres of Competence in Research” (NCCR) at the national level.

The Swiss Innovation Promotion Agency (CTI) is the federal agency for innovation, which supports joint projects between universities and private companies as well as innovation activities. The CTI is an independent decision-making body within the Federal Administration and reports directly to the EAER. The Swiss Science and Technology Council (SSTC) is the advisory body of the national government for science and technology policy.

Figure 1: Overview of Switzerland's research system governance



Source: elaboration of the author from ERAWATCH research inventory

2. RECENT DEVELOPMENTS OF THE RESEARCH AND INNOVATION POLICY AND SYSTEM

2.1 National economic and political context

In 2013, real GDP grew by 1.4% (provisional figure) on the previous year, compared to a EU 27 average GDP change of -0.1% and EU 17 GDP change of -0.4%. Internal consumption and the construction sector are important drivers of growth, both spurred by relatively good labour market conditions and low interest rates. The economy has been helped also by the healthy public finances, which did not need to become restrictive. The export-oriented sector has recovered after a period of pressure from the strong appreciation of the Swiss Franc vis-à-vis the Euro. The intervention of the Swiss central bank (BNS) introduced a floor at 1.20 Swiss Francs per Euro since September 2011 to stabilise the situation and reduce uncertainty, while in 2013 the Euro has further appreciated toward 1.23-1.25. Partially as a consequence of such policy, the export sector has fully recovered (SNB, 2013).

The international pressure on the financial sector has decreased, as bilateral agreements to improve tax compliance have been signed or will probably be signed in a next future (US treasury, 2013). Although these agreements may have positive effects in the short term, on the other side they may reduce the national attractiveness of capitals (Bloomberg, 2013). Swiss citizens, although wealthy, are the second most indebted in Europe behind the Netherlands; debt is predominantly related to house loans, which have expanded thanks to low rates; this situation may represent a potential source of risk in case of rate growth, replicating a scenario occurred in early nineties (Swissinfo.ch, 2012a).

The external pressure generated by the "Euro crisis" has spurred a debate on the levers available to stimulate competitiveness. There is a consensus that the only sustainable response is to climb the quality ladder through an even greater use of innovation and skilled labour. This has further strengthened the position of research, innovation and education policies, which benefit from wide, nonpartisan political support. Solid growth in budget allocations in these areas has been maintained, even though increasingly binding financial constraints and mixed economic perspectives imposed greater discipline and reinforced push towards prioritisation. Early evidences suggest that such policies have been effective in leveraging private investments in R&D, innovation and exports as well (Swissinfo.ch, 2012b).

2.2 Funding trends

2.2.1 Funding flows

Swiss research policy is characterised by continuity and stability although the economic stall has produced a downsize in R&D investment expansion. Between 2008 and 2012 expenditures for education, research and innovation grew by 6,3% annually, whereas the Federal Council goal is of 3.7% per year for the 2013-2016 period. GERD as a share of GDP remained rather stable, from 2.9% in 2004 to 3% in 2009.

The lack of instruments to directly support private R&D is a relevant characteristic of Swiss research funding. With only 1% of BERD funded directly by the State, Switzerland ranks at the bottom among OECD countries. Nevertheless, this type of investment is growing thanks to newly established initiatives (Swissinfo.ch, 2012b). Moreover, BERD to GDP ratio is the highest

among OECD countries except for Sweden and Japan, although it has stabilized after 2004 as a share of GERD (from 2.08% in 2004 to 2.11 % in 2008; from €7,728m in 2004 to €9,584m in 2008). Higher Education Expenditure on R&D (HERD) increased from 0.64% of GDP in 2004 to 0.77% in 2010, the highest among OECD countries after Sweden, and amounting €3,152m in 2008 (compared with €2,400m in 2004)¹. In contrast to other countries, Switzerland has very low expenditures for R&D at the federal level other than support to FIT and universities: GBOARD was €96m in 2008 (€112m in 2004) (EUROSTAT, 2008). Only 0.75% of GERD is carried out by the State directly, while this proportion amounts to about 13% in EU-27 in 2008. BERD as percentage of GERD is higher in Switzerland (73.5%) compared to EU-27 (62.5%), HERD as a percentage of GERD is at a similar level (CH: 24.2%, EU-27: 23.4% in 2008) (FSO, 2012a).

In recent years, the share of third-party funding of universities increased from 20% in 2000 to 24% in 2012 (FSO, 2012b). Public spending for FIT and Universities is planned to grow in the following years. The FITs will receive €7,901m over the period 2013-16, following 1,46 m € in 2012, equivalent to an annual increase of 3.9% (SBFI 2012). This is lower than the amount requested by the FITs council that asked for a yearly increase of at least 6% (Federal Council, 2012a: 2785). In recent years, there have been always increases in the FITs' budget. The Federal Council plans to grant €2,514m to Cantonal universities over 2013-16, representing an annual increase of 3.7%, a lower level than in the FIT domain and below the 10% increase sought by the SUC (Federal Council, 2012a: 2790-2). The amount going to Universities of Applied Science will be equal to €1,755m to over 2013-16, representing an annual increase of 4.8%.

Grants to the SNSF will be increased by 3.7% per annum, a rate considerably lower than the 13.3% for 2008-12. Grants to the CTI have increased slightly from €400m in 2008-11 and estimated €455m for 2013-16.

Overall, promotion of research and innovative activities is of high political priority and resource provision seems to be very good and place Switzerland among the strongest investors in R&D. Although the planned increases in budget are rather incremental in scope, there has been a moderate impact of the economic slowdown on R&D expenditures.

Table 1. Basic indicators for R&D investments*

	2009	2010	2011	2012	EU (2012) *
GDP growth rate	-1.9	+3.0	+1.9	+1.0	-0.4
GERD (% of GDP)	2.87 (2008)	NaN	NaN	NaN	NaN
GERD (euro per capita)	1,352 (2008)	NaN	NaN	NaN	NaN
GBOARD - Total R&D appropriations (€ million)	3078 (2008)	3,361.6	NaN	NaN	NaN
R&D funded by Business Enterprise Sector (% of GDP)	2.11 (2008)	NaN	NaN	2.16	NaN
R&D performed by HEIs (% of GERD)	24% (2008)	NaN	NaN	NaN	NaN
R&D performed by Government Sector (% of GERD)	1% (2008)	NaN	NaN	NaN	NaN
R&D performed by Business Enterprise Sector (% of GERD)	74% (2008)	NaN	NaN	NaN	NaN
Share of competitive vs. institutional public funding for R&D	30 vs. 70 % ** (2008)	32 vs. 68%	NaN	NaN	NaN
Venture Capital as % of GDP (Eurostat table code tin00141)	0.049	0.051	0.035	0.030	NaN
Employment in high- and medium-high-technology manufacturing sectors as share of total employment (Eurostat	7.11% (2008)	NaN	NaN	NaN	NaN

¹ Real term data for 2010 are missing.

² Investment data from official documents are in Francs, they were converted with a 1.21 ratio with the Euro

table code tin0011)					
Employment in knowledge-intensive service sectors as share of total employment (Eurostat table code tsc00012)	42% (2008)	NaN	NaN	NaN	NaN
Turnover from Innovation as % of total turnover (Eurostat table code tsdec340)	NaN	NaN	NaN	NaN	13.4 (2010)

*The EU27 (or 28 as far available) average data will be provided by IPTS in December 2013.

** FSO (2012c) Table T1 - Competitive = Public funding of domestic R&D programs/Projects + Public funding of international R&D programs/ projects abroad; Institutional =Public funding of domestic R&D institutions + Public funding of R&D institutions abroad

Note: The Swiss Federal Statistical Office implements a survey on R&D in the business sector every 4 years. The last survey took place in 2008; the 2012 wave is under collection and data at the national level will not be available before mid-2014.

2.2.2. Funding mechanisms

2.2.2.1. Competitive vs. institutional public funding

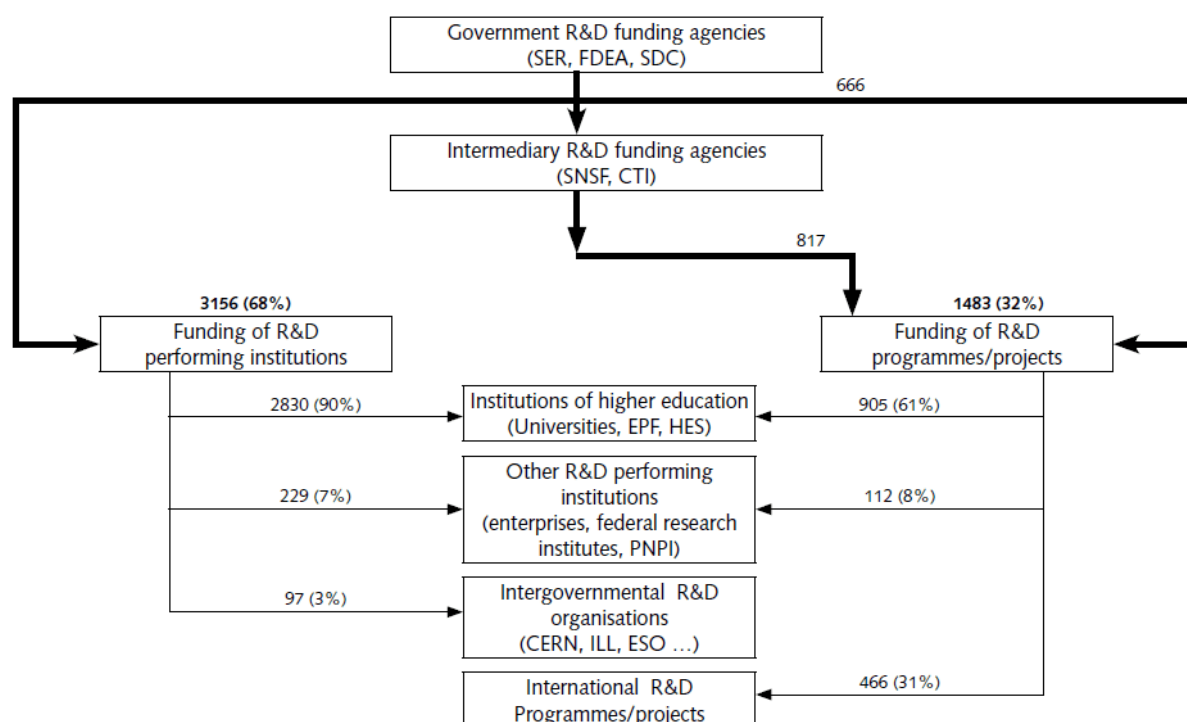
Public investment for R&D comprises all appropriations financed by the Confederation or the cantons. There are two main channels of funding. Basic public funding allocation displays a low level of competition and allows institutions much freedom in choosing what research to carry out. On the other hand, R&D programs/projects are research activities whose framework conditions (topics, goals, rules, etc.) are set by the funder. They are subjected to calls for proposals and allocated on a competitive basis; the government delegates this process to intermediary R&D funding agencies: SNSF and CTI.

The structure of funding modes changed considerably in the last decade, becoming more competitive. In the second half of the '00s, in particular, the share of basic public funding of R&D for domestic R&D funding institutions decreased from 75% in 2002 to 68% in 2004, and later stabilized (66% in 2010 of total public funding for R&D). This trend is partly related to Switzerland's growing participation in European framework programs, whose allocation competes with other funding modes: in fact, in the period 2000-2010 the relative share of funding for R&D programs/ projects in Switzerland increased from 19% to 22%, and that for international R&D programs/projects abroad from 4% to 10% (FSO, 2008). In absolute terms, the funding of R&D programs in Switzerland almost doubled and that of international R&D programs abroad almost quadrupled.

In the last three years, the amount of competitive national program allocation has rather stabilized: the budget of the SNF has slightly grown from €600m in 2010 to €624m in 2012 (SNF 2010, 2012), CTI budget has grown from €97m to €113m in 2012 (CTI, 2012). The funding flow to and from European competitive projects is expected to continue growing considerably. Swiss contribution to the 6th European Framework Program (2003-2006) amounted to €620m, while the contribution to the budget for FP7 (2007-2013) will amount to €1.980m (3.6% of the total €54.6bm). In parallel, Switzerland research received €636m during the 6th FP and €1,29bm were attracted in the 7th FP until June 2012 (SERI, 2012).

The basic funding is allocated by the federal government to the Federal Institutes of Technology (FIT), and by the Cantons, each one funding the universities on its territory. This allocation is not subjected to competition from other actors, but it is indeed monitored by the public authorities. Allocation is regulated via a performance contract where targets are specified in terms of quality and productivity of research as well as educational goals (satisfaction of students, employment after degree, etc.). The content of the contract is bargained and it is rather detailed, although the amount of funding is not directly linked to the performance, but it also depends on factors like the available resources to the Canton/federal level, investments in structural development, etc.

Figure - R&D funding model in Switzerland, 2010; In million CHF, at current prices and relative shares in %



Total: CHF 4639 million

Source: Data FSO according to B. Lepori's model, 2011 (FSO, 2012c)

2.2.2.2 Government direct vs indirect R&D funding³

The support to R&D via tax incentives remains rather weak, especially when compared to other OECD countries (KPMG, 2011). Several proposals have been advanced and some important initiatives have been promoted to favor venture capital investments (SECO, 2012).

2.2.3 Thematic versus generic funding

Reflecting the bottom-up principle adopted in Swiss research and innovation policy, there is generally no thematic focus of the R&D budgets. There are some notable exceptions. One is represented by the cooperation in aerospace in Europe. In addition, the State supports departmental research.

A considerable part of funding is dedicated to public-private partnerships and knowledge transfer. For example, National Research Programs (NRPs) and National Centres of Competence in Research (NCCRs) account for 11% of the SNSF's budget. The CTI's budget is almost exclusively focused on these purposes, although its overall budget is still small compared

³ Government direct R&D funding includes grants, loans and procurement. *Government indirect R&D funding* includes tax incentives such as R&D tax credits, R&D allowances, reductions in R&D workers' wage taxes and social security contributions, and accelerated depreciation of R&D capital.

to the SNSF's budget. In early 2013, CTI launched a new initiative, the National Thematic Networks (NTNs), which aims to provide long-term support for innovative activities in cooperation between businesses and public research institutes in eight areas of innovation which are deemed as important to the Swiss economy: 'Carbon Composites Switzerland', 'Inartis', 'Innovative Surfaces', 'Swiss Biotech', 'Swiss Food Research', 'Swiss Wood Innovation Network', 'Swissphotonics' and 'Logistics Network Association'

Bilateral and multilateral cooperation will continue to benefit from budget increases also in 2013-16, reflecting their importance for Switzerland. The annual growth rate, albeit lower than in the previous programming periods, ranges from 5.5% to 7.4% according to the line considered.

2.2.4 Innovation funding

Public funding is overwhelmingly allocated to programs whose prime goals reside in the field of basic and applied research. In particular, the budget of CTI, the body oriented to promote innovation with the support of the public finances, is six times less than the SNF as well as six times less than funding allocated through FP programs.

On the other hand, CTI introduced new instruments in 2013 specifically addressing long-term support for innovative activities. The already mentioned National thematic networks (NTNs). The IMs, Innovation mentors, e.g. contact persons for SMEs who help firms to find the right research partner in an academic institution, which aim to create contacts and identify, specify and implement ways of encouraging innovation. The KTT platforms, which provide a physical and interactive interface between innovation mentors and the national thematic networks.

2.3 Research and Innovation system changes

Until the end of 2012, responsibilities for research and higher education were divided between the Federal Department of Internal Affairs (EDI) and the Federal Department of Economic Affairs (EVD). Since the 1st January 2013 all the responsibilities dealing with research, innovation and vocational education and training have been brought under one roof and concentrated in the Federal Department of Economic Affairs, Education and Research (EAER) (previously EVD). The State Secretariat for Education and Research (SER), previously within the EDI, now belongs to the EAER and has become the State Secretariat for Education and Research and Innovation (SERI). The Federal Office for Professional Education and Technology (OPET) has been attributed to the SERI.

2.4 Recent Policy developments

The most relevant policy documents have been regrouped and presented within the ERI message for 2013-2016. This includes eleven financial decrees covering all national measures to be taken in the following areas: upper-secondary level vocational education and training (VET); tertiary-level B professional education and training (PET); tertiary-level A higher education, including the two federal institutes of technology and affiliated research institutes (FIT Domain), cantonal universities and universities of applied sciences (UAS); research and innovation. The ERI message also proposes a new federal law to support umbrella organisations involved in continuing education and training (CET). In addition, the ERI message proposes legislative amendments to five federal laws.

For the first time, the Federal Council devoted one of its guidelines to the Education, Research and Innovation (ERI) system in its Legislative Plan for 2011-2015, clearly stating that Switzerland considers education, research and innovation to be a top priority and formulating the following ERI policy guidelines (Federal Council 2012b):

- To satisfy the demand for skilled workers through general or vocational education and training;
- To consolidate the high level of grant funding awarded on a competitive basis;
- To further strengthen Switzerland's internationally competitive position;
- To establish Switzerland as a location where research and economic activities are based on the principles of equal opportunity, sustainability and competitiveness.

In accordance with the Legislative Plan, the Federal Council has submitted the "ERI message" for 2013-2016.

2.5 National Reform Programme 2013 and R&I

NOT APPLICABLE FOR SWITZERLAND

2.6 Recent evaluations, consultations, foresight exercises

The new policy developments, and in particular those promoted by the "ERI message" for 2013-16, result from the consultation and (intermediate) evaluations and take them into account (Federal Council, 2012a). The "ERI message" is prepared by the Federal Council after a broad consultation process between all relevant stakeholders and approved by the Parliament. The consultative, bottom-up approach is intended to grant that the opinion of different stakeholder at the national and regional level, as well as actors of the business sectors are included. Experts are also involved to assess strengths and weaknesses of the plan. Specific evaluations are not carried out for the "ERI message", and the Federal Council relies upon the latest available. For instance, for the FIT domain the intermediate evaluation for the 2008-2012 period was considered, which was drafted by a group of international experts. There has not been any systematic evaluation of research and innovation policy in recent years, besides internal reports conducted by OPET, SER, ETH board and also including external expertise. There are also a number of evaluations in specialised sub-areas of support activities that are summarised in the ERI message.

Over the next few years the SNSF will develop a systematic monitoring of the output of all projects supported. This implies that the applicants will have to provide data on publications, patents, scientific events, doctorates. The SNSF will also coordinate an external evaluation of the instrument used by the CTI to finance indirect expenses. The results will be used to define the future mechanism to finance overheads by both the CTI and the SNSF.

2.7 Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3)

- Although Switzerland does not have a proper RIS3, the current regional economic policy (2008-15) (SECO, ARE, 2011) features many aspects that characterise RIS3s. The regional policy provides financial incentives to cantons to cope with structural change

and it is designed to help specifically the lagging region in rural, mountainous and border areas. Among the aspects more closely related to RIS3s are:

- The promotion of innovation and excellence also in traditional industries (such as agriculture, tourism and energy) based upon the relative advantage and opportunities of the region (pillar 1).
- Coordination of regional policy with federal agencies. Role of the Confederation as facilitator of efforts initiated and developed by regions, and stimulating networking on a supra-regional and supra-national scale rather than a top-down definition of priorities (pillar 2).
- Providing expertise for regional policies (pillar 3)

Control lies with the cantons. Regions are expected to develop proposals coherent with their strengths, and particularly in toward establishing value creation systems with a supra-regional and international orientation, environmentally friendly tourism and in areas such as energy industry, forestry and agriculture, and education.

3. PERFORMANCE OF THE NATIONAL RESEARCH AND INNOVATION SYSTEM

3.1 National Research and Innovation policy

Switzerland scores considerably higher than the European average both in terms of R&D inputs and outputs. Among European countries, Switzerland is in the leading group regarding the investment in absolute terms and % of GDP, in the public and private sector as well. The country is seat of some of the largest research infrastructures, and displays very high levels of graduates, doctorates (3.6% in 2009, more than double the EU average) and number of researchers per total employees. The Swiss systems scores the highest value among the group of member states and associated countries in terms of Science and Technology Indicators, the index of economic impact of innovation, the knowledge intensity of the economy and second regarding HT&MT contribution to trade balance. The R&I system generates a high share of scientific publications within the 10% most cited scientific publication worldwide (18.2% in 2008), a high number of international scientific co-publications per million population (2505 in 2011), a high level of PCT patent applications per billion GDP (7.8 in 2009) (European Commission, 2013; European Commission, 2011). Key sectors are represented by Energy, Environment, ICT, Nanosciences and Nanotechnologies.

While Switzerland is one of the most innovative countries in the world, on the one hand, there is a relatively conservative attitude towards business and risk in Switzerland emerging from surveys among citizens and which is also evident by lower than EU levels of venture capital investment in seed and start up stages.

Table 2 Main S&T indicators

HUMAN RESOURCES	
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	3.4 (2011) ³
Percentage population aged 25-64 having completed tertiary education	36.6 % (2012) ¹
Open, excellent and attractive research systems	
International scientific co-publications per million population	2,505 (2008) ²
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	18.2% (2008) ³
Finance and support	
R&D expenditure in the public sector as % of GDP	0.79 % (2010, gov + HE sectors) ¹
Public Funding for innovation (innovation vouchers, venture/seed capital, access to finance granted by the public sector to innovative companies)	€110m (2012-CTI budget)
FIRM ACTIVITIES	
R&D expenditure in the business sector as % of GDP	2.11% (2010)
Venture capital and seed capital as % of GDP	0.77% (2009) ³
Linkages & entrepreneurship	
Public-private co-publications per million population	126 (2008) ²
Intellectual assets	
PCT patents applications per billion GDP (in PPSE)	7.8 (2009) ²

PCT patents applications in societal challenges per billion GDP (in PPSE) (climate change mitigation; health)	2.6 (2008) ²
OUTPUTS	
Economic effects	
Medium and high-tech product exports as % total product exports	62.6% (2010) ²
Knowledge-intensive services exports as % total service exports	26.5 % (2010) ²
License and patent revenues from abroad as % of GDP	2.95% (2011) ²

¹ source: Eurostat

² sources: Innovation Union Competitiveness report 2011 and/or Innovation Union Scoreboard 2011

³ sources: OECD

⁴source: European Commission (2013)

3.2 Structural challenges of the national R&I system

Five main structural challenges can be identified, elaborated coherently with the priorities for 2013-2016 set by the Federal council, key R&I areas considered in previous Erawatch analysis as well as more in-depth analysis of the system. These challenges regards the mobilisation of resources, the R&I portfolio, the knowledge demand, production and circulation. In this section the national strengths and weaknesses are analysed as well as policies in place to meet these challenges. In section 3.3 the future policy intervention identified by the 2013-2016 ERI guidelines of the Federal Council are also highlighted.

- Resource mobilization

Switzerland ranks among the top countries in the world both regarding public and private investment in R&D. Hence, the only potential source of weakness can be identified in a rather strong specialization.

Public expenditures are strongly concentrated on supporting basic as well as applied research in universities. The value of public investment is very high in absolute terms and high in terms of share of GDP (sixth position in 2009 with HERD intensity well above the EU and OECD average) (OECD, 2011: 78). On the other hand, there are almost no direct funding of BERD with public funding, and support via projects, public procurement, etc. have a small impact, resulting in a weak steering capability and little support to sectors that can be relevant in the future but not central in the private sector' agenda.

The investment of the Business sector is very high both for research as well as for innovation, via venture capital, and spurred by initiatives such as "CTI Invest" events, where start-up companies in the research stage can present themselves and their ideas to potential investors (see section 4). On the other hand, there is a need to increase seed and start-ups venture capital, which are below the EU standards, and remarkably lower the standard of Swiss venture capital investments in early and later stages of venture capital.

- R&I portfolio

Switzerland's high levels of private research investment are nevertheless concentrated in a few core sectors – chemicals, pharmaceutical, machine industry –where the main Swiss multinationals companies operate. Such an investment profile entails a risk of excessive specialization in terms of sectors and overdependence on few pivotal large companies. More variety in the R&I portfolio can be beneficial from a risk management perspective, and for which the public intervention can be required.

- Knowledge demand

Switzerland displays a high proportion and higher annual growth rates of employees in knowledge-intensive activities than EU (42% vs. 35%; European Commission, 2011b: 383). Partly, this may be explained by the strong position in high-tech manufacturing fields, particularly four of them amount 70% of the export value: chemical products and pharmaceuticals (34%), machine industry and electronics (12%) and precision instruments and watches (8%), Information and communication technologies (16%) (FSO, 2013). Switzerland also displays a trend towards more employment in high-tech industries (with a growth rate of 2.6% between 2008 and 2009), whereas other European countries have experienced strong declines (the EU growth rate is -3.5% over the same period). (European Commission, 2011b: 386). Moreover, the transition to service oriented economy is occurring at a slower pace than in other European countries, with a persistent request of highly skilled employees.

The satisfaction of the knowledge demand is characterised by a strong bottom-up approach and an extensive involvement of social and economic stakeholders in the design of the education and research policies, and a key role of researchers and private companies on research direction and content. Instead, there are relatively few policy instruments focusing on thematic priorities, although these are one of the priorities of the 2013-2016 ERI guidelines of the Federal Council. The internal offer of highly skilled has not been able to meet internal demand, which has been satisfied through massive inflows of foreign workers, especially from neighbouring EU countries. These favourable conditions of attractiveness may not persist in the future and challenge the long term capability to meet the internal demand of highly skilled.

- Knowledge production

Knowledge production by higher education and private institutions is among the best in the world. In terms of quality and impact of its scientific production, Switzerland holds the second rank in the relative publication and citation index (State Secretariat for Education and Research, 2011a) and has the highest rate of high-quality publications among OECD countries. Also, Switzerland has the largest graduation rate at doctoral level of all OECD countries, reaching 3.4% in 2009. The percentage of graduates in science and engineering is about 40% which is only slightly above the OECD average (OECD, 2011: 68-89). In 2010, about 35% of the population between 25 and 64 years had a higher education degree (EU21: 28%) (OECD, 2012: 40).

Policy initiatives main goal is to preserve the high quality of the research system, while the development of research findings into marketable products and services has been mainly driven by the private sector (SERI, 2013). Hence, there is need to bridge fundamental research to practical application for the sake of economic progress. Policies in such sense have been mostly promoted through CTI and via the research activity of UAS.

- Knowledge circulation

There is a long tradition of collaboration between research institutes, universities and private companies favoured by informal contacts and transfer of people. Traditionally, cooperation between public and private R&D performers and the transfer of research results have been left to bilateral contacts between universities and companies with little intervention from the State.

In the last decades, the promotion of cooperation and technology transfer has become a central element of Swiss research and innovation policy. The Swiss National Science Foundation (SNSF) fosters cooperation among researchers by using it as an evaluation criterion and provides instruments explicitly requiring cooperation, notably the interdisciplinary instruments “National Research Programme (NRP)” and “National Centre of Competence in Research (NCCR)”. Most of the CTI budget is devoted to projects promoting cooperative research between higher education institutions and private companies. The SNSF also encourages cross-border knowledge circulation by facilitating mobility of researchers (ERAWATCH Network, 2010).

The main challenge can be identified by the limited cooperation between private firms, with only about 40% of large firms are engaged in collaborations on innovation activities with other firms,

compared to 70-80% in other countries as Denmark, Finland, Belgium or Austria. Also, relatively few firms are engaged in international collaborations (OECD, 2011:104 and 106).

3.3 Meeting structural challenges

Table 3 Structural challenges and public responses

Challenges	Policy measures/actions addressing the challenge ⁴	Assessment in terms of appropriateness, efficiency and effectiveness
1. Public and private resource mobilization	ERI 2013-2016 policy guidelines: increasing the amount of grant funding awarded on a competitive basis for research and innovation. 'CTI' invest initiative.	The amount of public funding to R&D is expected to remain stable in the next years. Emphasis is on the allocation procedures rather than the amount of resources, which are indeed considerable. The CTI invest can hardly produce a systemic impact regarding funding to seed and start up.
2. R&I portfolio	ERI 2013-2016 policy guidelines: i) ensuring that Switzerland holds a top position in promising fields through targeted measures to improve research, development and innovation capabilities, while leaving enough room for unconventional research approaches. ii) Investing in strategically important research infrastructures at the national and international levels. Support to lagging regions CTI collaboration project	So far, the bottom-up approach has partly led to a self-reinforcing cycle towards strong specialization and excellence in specific research domains, especially in the private sector, whereas public interventions were of limited scope and towards SMEs. In the next future specific interventions are intended to avoid the risk of losing ground on key emerging sectors. Efficacy probably depends on the amount of resources invested.
3. Knowledge demand	ERI 2013-2016 policy guidelines: i) Ensuring a wide range of diverse and permeable education and training programmes through balanced funding of general education and Vocational / professional pathways. ii) Improving the learning capabilities and employability of young people by ensuring that at least 95% obtain upper-secondary level qualifications	Some weaknesses can be identified in the capability to meet the demand of highly skilled workers with the internal supply. Emphasis of the educational policy has been and remains on excellence and variety of training. Targets in terms of quantity regards the participation rates to upper secondary level, rather than increasing the number of graduates.
4. Knowledge production	ERI 2013-2016 policy guidelines: i) ensuring the high quality and solid international reputation of the Swiss higher education sector, particularly by creating adequate professor-student ratios. ii) Maintaining the quality of baccalaureates by ensuring that baccalaureate holders have acquired the requisite academic skills. iii) Allocating greater funding to train the next generation of researchers and qualified workers.	So far, the Swiss system has been guided by a clear separation between the public and private spheres, both performing at an excellent level, and a bottom-up approach for theme selection and collaboration. This approach entailed a gap between fundamental and applied research, which has been partly addressed through the CTI, although its scope and budget are still limited. Most initiatives aim at maintaining the high quality and profile of people and research structures.
5. Knowledge circulation	Emphasis on collaboration and circulation as criteria for R&D public funding. ERI 2013-2016 policy guidelines on i) maintaining the strategic importance of international cooperation and networking with European and non-European countries. ii) Improving cooperation between research institutes and the private sector. iii) Strengthening social cohesion through the production, dissemination and use of knowledge	Effective in the public-private arena, although there is a lack of an overall coordination between larger policy areas on research and economic affair, and private – private collaboration ties are not addresses

⁴ Changes in the legislation and other initiatives not necessarily related with funding are also included.

4 NATIONAL PROGRESS IN INNOVATION UNION KEY POLICY ACTIONS

4.1 Strengthening the knowledge base and reducing fragmentation

Promoting excellence in education and skills development

Swiss universities and FITs receive large endowment and have a clear mission to perform research activity of high quality. The universities of Geneva, Zurich, Bern and the ETHZ are in the top 100 of the Shanghai ranking, the ETHZ ranks 20th and it is the first institution in the world behind American and British universities (Shanghai ranking, 2013). When the average impact of scientific works is considered, the Swiss universities perform even better with six institutes in the top 100 and EPFL ranking 13th in the Leiden ranking 2013 according to the impact indicator. The quality of training is also good, as testified by the attractiveness of foreign PhDs (over 50%) and Bachelor students (14%, source: EUMIDA dataset, 2009).

An important challenge for Swiss research policy is to further strengthen its universities. While this is already the case for some of them – especially for the two Federal Institutes of Technology – cantonal universities need a stronger effort in this direction. At the political level, initiatives have been undertaken to grant universities more autonomy and strategic capability but conflicts emerged in this respect between some universities and cantonal authorities, for priority in setting the strategic direction.

The impact of the economic crisis resulted into a slowdown, rather than reduction, of the investments in research and Higher Education and the promotion of new policy initiatives more directly oriented to promote innovation into companies, especially medium sized ones. The attractiveness of human capital, in terms of the balance of inward versus outward flow of researchers, has not declined; instead, it has increased given the relative good economic performance of Switzerland when compared to neighbouring countries: the foreign share of academic staff in Swiss universities has grown from 36% to 42% between 2007 and 2012 (FSO Database).

The CRUS has been on the forefront into promoting Euraxess initiative and the implementation of HR Strategy for Researchers and the charter code into Swiss HEIs. This decision was taken in 2005, and followed by participation in the labelling process in 2007, further subscribed by rectors and president of Swiss HEIs in 2008 (CRUS, 2005, 2007, 2008). In recent years, several events have been promoted by CRUS to sponsor and diffuse the initiative, and each Swiss HEI now has a Euraxess service centre which act as bridgehead organizations (BHO) in coordination with Euraxess Zurich. In turn, these initiatives are autonomously adopted and promoted by universities; there is governmental mandate from SERI, whereas there is not a formal supervision or assessment.

Switzerland participates in the European framework programs and in a number of projects of the European Science Foundation (ESF), where Swiss researches have been quite successful in obtaining funds.

Switzerland cooperates in numerous international programs and organizations, such as:

- European 'Eureka' Initiative for the promotion of marketable technologies
- European cooperation in scientific and technical research - COST
- Global research program Intelligent Manufacturing Systems - IMS
- International Human Frontier Science Program (HFSP) in neurobiology

- The European Space Agency ESA and the European Southern Observatory - ESO
- European Molecular Biology Laboratory (EMBL) in Heidelberg (Germany)

It is a priority to deepen international scientific ties. In fall 2000, a scientific consulate - the Swiss House for Advanced Research and Education (SHARE or swissnex) opened in Boston (Massachusetts, USA) with the goal to increase the connectedness of Swiss Science (<http://www.shareboston.org/>). In the meanwhile, other seats have been opened in India, San Francisco, Singapore and China.

Research Infrastructures

On the basis of the Swiss Roadmap for Research Infrastructures (SRRI), the federal government confirmed its commitment to the construction and operation of ESFRI. In particular, to

- i) ESFRI projects for which the European consortia have already been formed and to which Switzerland already participates actively,
- ii) Research infrastructures object of positive preliminary decisions or that are strictly related to Switzerland's international obligations;
- iii) Infrastructures for biomedical research and protected sites for research on biosafety.

No specific policy or initiative has been adopted recently regarding the barriers to cross-border access to RIs, which are generally accessible to foreigners particularly from EU/EFTA States. The access to researchers from other countries is not problematic either, as restrictions to foreign workers are lessened for highly qualified workers.

Switzerland cooperates in the development and maintenance of some very large scale research infrastructures, the most notable being the European Organization of Nuclear Research CERN (Switzerland / France), the fusion program of Euratom, the European Atomic Energy Community, the European Synchrotron Radiation Facility ESRF in Grenoble (France)

4.2 Getting good ideas to market

Improving access to finance

Switzerland is one of the most innovative countries in the world, but a great challenge is to get ideas to the market. On the one hand, there is a relatively conservative attitude towards business and risk in Switzerland, as testified by surveys among citizens and university students, whose entrepreneurial ambitions are below average internationally (GEM, 2010; Sieger, Baldegger, Fueglistaller, 2011). On the other hand, several rankings on innovation point out the quality and marketability of innovation in Switzerland (first in the Global Innovation Index.org).

The situation regarding access to funding for innovative products and services presents several positive elements and some limitations as well. The Federal Law Governing Venture Capital Companies (GRKG) was set in 1999 and expired at the end of April 2010 with no follow-on law, as it did not generate the desired results: in ten years only 31 companies filed official request at SECO. Moreover, Switzerland does not participate to EuVECA as it is not a member state of EU.

Over the past few years the Swiss parliament has passed numerous amendments to legislation which have had a positive impact on venture capital, including the Law on Collective Capital Investment and the Corporate Tax Reform II. In the legislative planning for 2011-2015, the Federal Council aims to reform the Swiss tax code to simplifying taxation and remove distortions. The venture capital market more than quadrupling over the past ten years, and it is now well above the European average (EVD and SECO, 2012), being fourth in 2009 in the

percentage of venture capital to GDP at 0.077 %, and first in terms of investment in seed, start-up and early-stage 0.055 % (OECD, 2009). However, if only the share of financial capital for seed and start up is considered then Switzerland perform worse than other European countries and this sum has even declined in the past five years by two-thirds. Venture capitalists preferably invest at a later stage, when the risk is smaller, and especially in times of economic uncertainty (EVD & SECO, 2012). Inflows of risk capital from abroad exceed the outflows of domestic capitals.

CTI is the main actor supporting innovative projects in cooperation between public and private sector, not merely through funding but also with professional advice and assistance. CTI stimulates cooperation between science and businesses through the annual financing of several hundreds of joint R&D projects. There is no thematic steering neither a pre-allocation between different areas, but rather it is quality, innovation and economic potential impact of proposals that drives the selection of the projects. The funding support is granted solely to universities, while SMEs co-fund the project while accessing R&D services and infrastructure at the universities to carry out their own innovations faster. The CTI project support is sustainable and effective: it has existed for more than 60 years, and on average, businesses contribute with 1.30 francs for each franc of public investment.

The “CTI Start-up” provides to entrepreneurs the training from experts of various areas during the start-up stage. The training process uses three clearly structured steps to obtain the CTI Start-up Label, which is helpful also in making their product more visible.

An important public-private partnership initiative is “CTI Invest”, whose motto is “from science to money to market”, and aims to fill the financing gap in the start-up stage. It is a private independent association of investors which organizes events where start-up companies in the research stage can present themselves and their ideas to potential investors, as well as networking events for exchange of information and knowledge. Business Angels are involved to provide their expertise and contacts to a company in the early stages (EVD & SECO, 2012).

CTI also promotes innovation vouchers which allow applicant firms to purchase services from universities and Public Research Organizations (PROs). The budget for this initiative is around €0,8m per year.

A further important support for innovation resides at the cantonal level. There is a strong cooperation between cantonal economic support agencies, regional chambers of commerce, cluster organizations, founding centres, surety companies and knowledge and technology transfer agencies. The cantonal agencies act as intermediaries and consulting offices for venture capitalists. Many cantons provide commercial sureties and can assume a share of possible losses. Cantons attract investors via grant tax easements or tax waivers. Cantons can also receive a direct support through federal financial aid to support projects, regional companies and international cooperation. Low-interest loans are granted for infrastructure projects or tax breaks on direct federal taxes, and new regional policies under the umbrella of Directive 1, which aim at improving regional competitiveness and adaptation to globalization requirements (EVD & SECO, 2012).

In sum, although Switzerland does not contribute to CIP, nevertheless SMEs seem increasingly the target of R&D policies and the country is involved in the Enterprise Europe Network.

Protect and enhance the value of intellectual property and boosting creativity

Switzerland is a leading country in terms of patenting (second in the world after Japan in the number of patents per million inhabitants). It is a member of EPO, but it will not ratify Agreement on a Unified Patent Court as it is not a member of EU 25. Switzerland and Liechtenstein have the same patent regulations based on a bilateral patent treaty. The national patent office provides courses as well as an online tool to support potential applicants into exploring the opportunity to protect their idea and how to commercialize it (<https://www.ige.ch/guide/e/default.shtm>).

Public procurement

Demand side policies have minor importance in the Swiss innovation policy frame. Nevertheless, three initiatives occurred, which may have indirect positive spill overs in terms of production of innovative goods and services. First, the Swiss Federal Law on public procurement has been recently revised to modernize the process and facilitate innovation; the SwissEnergy measure fosters demand for clean technologies; and third, two National Research Programs analyse the risks and benefits of nanotechnology and genetics, thereby potentially improving the acceptance of these technologies (PROINNO, 2011).

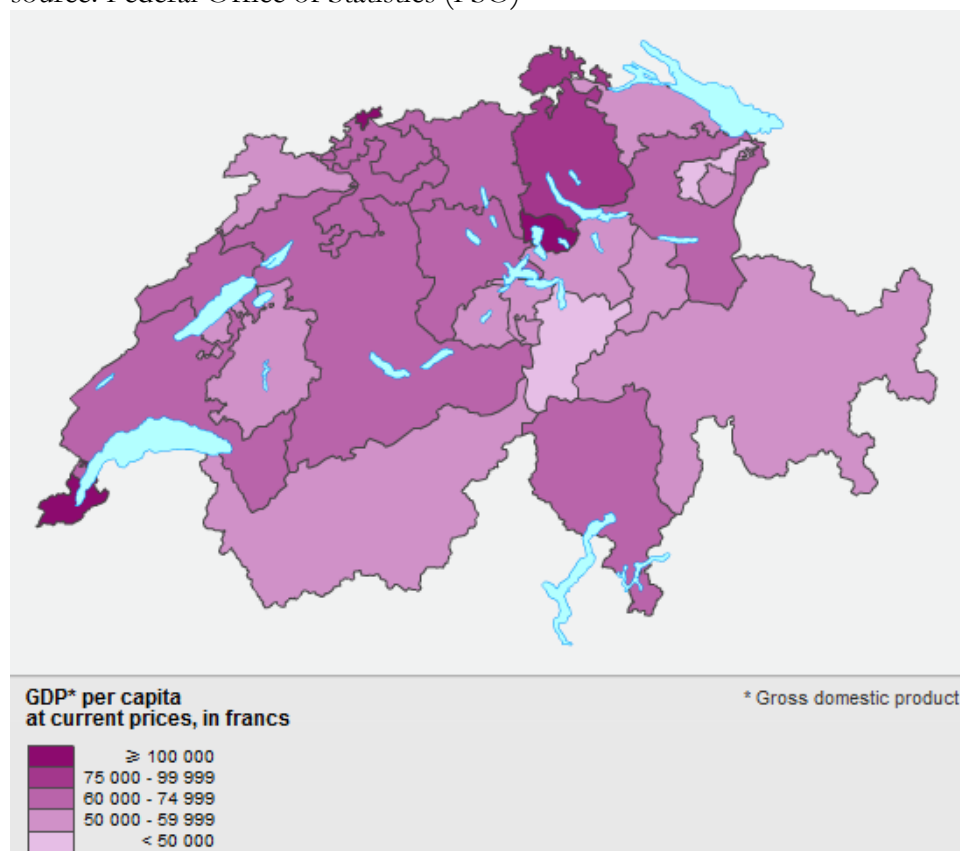
4.3 Working in partnership to address societal challenges

In general, Swiss participation in international programs and opening of national programs reflects the decentralised nature of Swiss research policy and less focus on grand challenges. This implies that there is no overall planning of such initiatives and of the domains where joint programming should be promoted. Since both the SNSF and the CTI are based on a bottom-up approach to project selection, they do not devote a large share of their resources to joint programs. This can be an obstacle to the participation to large structural initiatives like Joint Technology Initiatives. On the other hand, research funding organisations are generally willing and financially capable to participate: the funding situation of Swiss partners in ESF initiatives, COST and Eureka is generally more favourable than other European partners (Lepori 2011: 27).

4.4 Maximising social and territorial cohesion

Switzerland is traditionally characterized by a remarkable inequality in the distribution of wealth among cantons (Figure 2), and more specifically along the axes urban – country regions, with the latter being targeted by specific policies aimed to avoid further depletion of human and economic resources. Such policy interventions have traditionally targeted economic activities in which mountainous and border areas display a relative strategic advantage, such as energy, tourism and agriculture. The recent regional economic policy (2008-15) (SECO, ARE, 2011) maintains this approach, while emphasis is also placed in generating innovation in these fields. The efficacy of such policies has not been specifically assessed yet. Nevertheless, it is interesting to note that in the 2008-2011 period most of the lagging cantons in the German part have been characterized by higher than the average GDP growth, and particularly the Nidwalden (+8,3%), Graubünden (+5,4%), Schaffhausen (+4,3%). On the contrary, the economy of French lagging cantons has rather declined (FSO).

Figure 2 – GDP per capita 2011 at current prices in francs of the Cantons in Switzerland – source: Federal Office of Statistics (FSO)



4.5 International Scientific Cooperation

Restriction and quotas to immigration from European countries were abolished in 2002, rendering the Swiss labour market for researchers more open. The exchange of qualified workers has gradually increased, although there are still temporary scarcities and a lack of skilled workers, especially in sciences and engineering. At present, the labour market for researchers is among the most attractive, internationalized and developed in Europe. The number of researchers versus total population is 13 per 1000 inhabitants, compared to an average EU27 of 7.3 and average Euro area of 9.8 (Eurostat, 2009). Switzerland is a net importer of knowledge intensive human capital: foreign researchers represent almost 50% of the HE researchers and 25% of the highly skilled overall (Seeber and Lepori, 2014; OECD, 2008). The salaries of the researchers in Switzerland are the highest in Europe both in Real and Purchasing Power terms, and in the public and private sector (European Commission, 2007).

Switzerland reached an agreement with Germany (DFG) and Austria (FWF) concerning joint financing of bilateral and trilateral projects, where submission and evaluation take place in one of the three countries, while funding is on national basis (lead agency procedures) or from the country where most of the research is performed (money follows cooperation line procedure). For researchers moving abroad, it is possible to transfer SNSF funding to finalise the project.

As a general rule, nationality is not a criterion for participation in Swiss research programs. What is generally required instead, is to have a stable long-term appointment in a Swiss institution (this applies also to professors living in trans-border regions and working in Swiss universities). SNSF

funding for stays abroad is not restricted to the European Union, hence allows outward mobility to third countries as well.

Cooperation with third countries generally differs little from cooperation with partners from the EU. Hence, the general international orientation of Swiss research and innovation policy applies for third countries as well. Similarly, those programs that allow foreign institutions to acquire funding are generally open to both Europe and third countries. Said that, attractiveness of foreign talents is mostly from other European countries, while there is not a specific policy targeting US researchers. Among PhD students, for instance, 36% comes from other European countries, 6% from Asia, whereas the attractiveness of Nord American students is small (1%) (OECD,2008).

5 NATIONAL PROGRESS TOWARDS REALISATION OF ERA

This section briefly assesses the state of the art regarding the pursuit of the five ERA pillars.

When looking to the relevance of the ERA for Swiss research policy, one needs to consider that Switzerland is not a member of the EU and thus, unsurprisingly, very few references to ERA policies can be found in Swiss official documents. Nevertheless, Swiss research policy largely complies with the spirit of ERA objectives and the related priorities.

5.1 More effective national research systems

Swiss research policy reflects a bottom – up, decentralized approach, with less focus on grand challenges. This can be an obstacle to the participation to large structural initiatives like Joint Technology Initiatives. On the other hand, research funding organisations are financially capable to participate and the situation of Swiss partners in ESF initiatives, COST and Eureka, is generally good.

In the last decade funding modes changed by becoming more competitive. In the second half of the '00s the share of basic public funding of R&D for domestic R&D funding institutions decreased from 75% in 2002 to 68% in 2004, and later stabilized (66% in 2010 of total public funding for R&D). In the period 2000-2010 the share of funding for R&D programs/ projects in Switzerland increased from 19% to 22%, and that for international R&D programs/projects abroad from 4% to 10% (FSO, 2012c). In absolute terms, the funding of R&D programs in Switzerland almost doubled and that of international R&D programs abroad almost quadrupled. Allocation of competitive funding follows a rigorous peer review procedure.

5.2 Optimal transnational co-operation and competition

The Lead Agency Process aims to simplify the evaluation of transnational projects with German, Austrian and Luxemburgish partners, reflecting a mutual recognition of evaluations conforming to international peer-review standards and the cross-border interoperability of national programs.

On the basis of the Swiss Roadmap for Research Infrastructures (SRRI), the federal government confirmed its commitment to the construction and operation of ESFRI. In particular, to

- i) ESFRI projects for which the European consortia have already been formed and to which Switzerland already participate actively,
- ii) Research infrastructures object of positive preliminary decisions or that are strictly related to Switzerland's international obligations;
- iii) Infrastructures for biomedical research and protected sites for research on biosafety.

No specific initiative has been adopted in recent times regarding the barriers to cross-border access to RIs, which are already accessible to foreigners particularly from EU/EFTA States. The access to researchers from other countries is not problematic either, as restrictions to foreign workers are lessened for highly qualified workers.

5.3 An open labour market for researchers

The Swiss labour market is fully open to European workers ever since the abolishment of restriction and quotas to immigration in 2002. The exchange and inflow of qualified workers is high and growing. Overall, the Swiss national labour market for researchers is among the most attractive, internationalized and developed in Europe, with very high share of foreign researchers both in the academia and in the private sector.

5.4 Gender equality and gender mainstreaming in research

In the last four year, some new policy initiatives have been adopted toward gender equality and mainstreaming in research aimed at using the women's potential to improve the innovative capacities of Swiss companies and to counter the under-representation of women in top academic positions.

5.5 Optimal circulation, access to and transfer of scientific knowledge including via digital ERA

The circulation, access and transfer of scientific knowledge have been promoted by specific initiatives since decades, and new recent measures have been adopted to exploit the potential of digital communication system, like the establishment of the ARAMIS information device. Public – private cooperation in research projected has been also intended as an important indirect way to involve business actors into research activity while improving knowledge transfer. More recent policy instruments such as the National Thematic Networks (NTNs) aims to provide direct long-term support for innovative activities in cooperation between businesses and public research institutes in areas of innovation which are deemed as important to the Swiss economy

Annex 1. Performance the national and regional research and innovation system

Feature	Assessment	Latest developments
1. Importance of the research and innovation policy	(-) R&I Policy governance has been traditionally fragmented (-) there has been a lack of public direct investments in promising fields (+) R&I recognized as a priority by all parties, with increasing funds	(+) recent integration of Research and Education duties within a unique department, SERI (+) SERI guidelines for 2013-2016 identify the need for investment in specific, promising sectors
2. Design and implementation of research and innovation policies	(+) the federal council sets priorities for R&I on a four year period, which drives implementation policies (+) involvement of relevant stakeholders at several levels of the design project (+) clear planning of resource development on a 4 year range (-/+) policy is independent by EU orientation, although largely coherent with its main goals, principles and in coordination with it (-/+) effective evaluation for funding allocation. (-) lack of systematic ex-post evaluation	(+) smart specialization-like interventions toward lagging regions now emphasize also innovation
3. Innovation policy	(+) Switzerland self-promote as a highly innovation oriented country, both internally and externally (-) demand side innovation policy have small entity	
4. Intensity and predictability of the public investment in research and innovation	(-/+) public investment is high on absolute terms, predictable and prioritized (-) tax incentives have a little role at federal level (+) canton attract investments via fiscal policies (+) leveraging of private funds in CTI projects	(+) leveraging of private fund in recent initiatives
5. Excellence as a key criterion for research and education policy	(+) R&D funding is allocated on a competitive basis (-) institutes are not evaluated as such (+) ex-ante evaluation of projects (+) research funding are portable (+) HE and research institutions enjoy large autonomy in organizing their activities, and recruitment procedure are open (+) research careers are highly attractive for Europeans, less for American researchers	
6. Education and training systems	(+) there is a strong emphasis on hard and technical sciences as well as vocational one (+) Cantons are in charge of educational policy stimulate variety of approaches, critical thinking, and training	(+) ERI guidelines for 2013-2016 aim at consolidating the national and international position of Vocational and professional paths by giving by giving equal value to general education
7. Partnerships between higher education institutes, research	(+) CTI and aims at supporting the development, financing and commercialisation of innovative ideas, with an orientation to SMEs and collaboration	

centers and businesses, at regional, national and international level	<p>with HEIs and PROs</p> <p>(+) Researchers and innovators move easily between public and private institutes</p> <p>(+) Clear rules on the ownership of intellectual property rights and sharing</p> <p>(+) TTO are in place to facilitate knowledge transfer and the creation of university spin-offs and to attract (venture) capital and business angels. Some TTO are in common between groups of universities.</p> <p>(+) there are no obstacles to setting up and operating transnational partnerships and collaborations.</p>	
8. Framework conditions promote business investment in R&D, entrepreneurship and innovation	<p>(+) Switzerland is highly attractive of venture capital and R&I foreign investment</p> <p>(-) weak venture capital for seed and start up stage</p> <p>(-) small support via tax deductions or similar</p> <p>(+) very effective bureaucracy and clear rules</p> <p>(+) targeted policies at regional level to attract foreign firms</p> <p>(-) overall small coordination between economic and R&I policies</p> <p>(+) effective property right legislation</p> <p>(+) Swiss Association for Standardization (SNV) interface with various other national and international standards networks</p>	(+) Changes Law on Collective Capital Investment and the Corporate Tax Reform II
9. Public support to research and innovation in businesses is simple, easy to access, and high quality	<p>(+) CTI is clearly the main actor for public support to R&I</p> <p>(-) CTI budget is growing although still limited</p> <p>(-) weak public support to highly risk innovation initiatives</p> <p>(+) allocation of funding occurs via evaluation procedure and allows</p> <p>(+) CTI initiative to support young companies in the commercialization of products</p> <p>(+) bottom – up approach in SME funding in the frame of CTI collaboration projects</p> <p>(-) no direct financial support to SMEs</p>	(+) support to emerging sector is a goal of the ERI 2013-2016
10. The public sector itself is a driver of innovation	<p>(-) weak policies of public procurement</p> <p>(+) the ARAMIS information system (since 1997) makes information on research projects and assessments accessible to the general public</p> <p>(-) very small public investment in government R&D</p>	(+) recent initiatives regarding public procurement system, clean energy policy and genetic-nanotechnology, can represent demand driven support for innovation

Annex 2. National Progress on Innovation Union commitments

		Main changes since 2011	Brief assessment of progress / achievements
1	Member State Strategies for Researchers' Training and Employment Conditions	No relevant changes	(+) the principles of the Charter \rightarrow Code have been long subscribed and promoted by university association and its members. It is a bottom –up process with little policy overview and interference. Promotion of the code is still going on. (-) there is not an external evaluation assessing the implementation of the code principles
4	ERA Framework		Separate deliverable
5	Priority European Research Infrastructures	Swiss Roadmap for Research Infrastructures (SRII) document confirmed its commitment to the construction and operation of ESFRI (SER, 2011).	(+) RIs are generally accessible to foreigners from EU/EFTA States, and access to researchers from other countries in not problematic either (+) Continued commitment to ESFRI
7	SME Involvement		(-) No partnership with EU and EC on R&I for SMEs
11	Venture Capital Funds	The Federal Law Governing Venture Capital Companies (GRKG) expired at the end of April 2010 with no follow-on law. New amendments to legislation regarding venture capital (Law on Collective Capital Investment and the Corporate Tax Reform II). The federal government intends to reform the Swiss tax code to simplifying taxation and remove distortions on venture capital during the legislative planning for 2011-2015	(-) Switzerland is not eligible to EuVECA as it is not a member state of EU (+) The venture capital market in Switzerland more than quadrupled over the past ten years, and investment to GDP ratio is among the highest in the world (+) Inflows of risk capital from abroad exceeds the outflows of domestic capitals. (-) The financial capital for seed and early stage is very modest and declined in the past five years by two-thirds
13	Review of the State Aid Framework		Switzerland is not submitted to State aid EU legislative measures ⁵
14	EU Patent		(-) No ratification of the Agreement on Unified Patent court as Switzerland is not a member of EU 25 (+) Member of EPO
15	Screening of Regulatory Framework		No recent formal screenings
17	Public Procurement	Revisions to the Swiss Federal Law on public procurement	(+) Revisions to the Swiss Federal Law on public procurement have modernized the process, which now facilitates innovation (-) Demand driven policies have little importance in the Swiss frame of innovation

⁵ http://europa.eu/legislation_summaries/competition/state_aid/126078_en.htm

20	Open Access		<p>(+) The Federal Law on the Promotion of Research and Innovation (FIFG, 1983) specified that research institutions must take care that their research results are available for the public</p> <p>(+) SWITCH Foundation (since 1987) promote optical fibre interconnection of universities, universal login procedures, the digital repositories library and applications of e-identity to academia.</p> <p>(+) the ARAMIS information system (since 1997) makes information on research projects and assessments accessible to the general public</p>
21	Knowledge Transfer		<p>(+) CTI finances joint R&D projects between universities and companies in applied research and development</p> <p>(+) National Thematic Networks (NTNs), Innovation Mentors (IMs) and physical and web-based plat-forms for Knowledge and Technology Transfer (KIT platforms), aims at establishing contacts between businesses and public research organizations.</p> <p>(+) The “CTI Start-up” provides to entrepreneurs the training from experts of various areas during the start-up stage..</p> <p>(+) “CTI Invest” organizes networking events for start-up to exchange information and knowledge.</p>
22	European Knowledge Market for Patents and Licensing		<p>(+) The national patent office provide courses as well as an online tool to support potential applicants into exploring the opportunity to protect their idea and how to commercialize it</p>
23	Safeguarding Intellectual Property Rights ⁶		<p>(+) the Swiss Association for Standardization (SNV) interface with various other national and international standards networks</p> <p>(+) In 2013 the SNV have been selected to be a member of the ISO</p>
24	Structural Funds and Smart Specialisation	Regional economic policy (2008-15) (SECO, ARE, 2011)	<p>(+) In the frame of the regional economic policy 2008-2015, projects inspired by the smart specialization principles were initiated toward less developed and peripheral regions</p>
25	Post 2013 Structural Fund Programs		Not applicable
26	European Social Innovation pilot		(-) No specific policies
27	Public Sector Innovation	Marcel Benoist Prize is an yearly prize, awarded to a scientist of Swiss nationality or residency who has made the most useful scientific discovery affecting	

⁶http://europa.eu/legislation_summaries/competition/firms/126062_en.htm; <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2011:011:0001:0072:EN:PDF> article 7 on standardization agreements; http://www.cjel.net/online/18_1-johansson/

		human life.	
29	European Innovation Partnerships		(+) participation in several initiatives ⁷
30	Integrated Policies to Attract the Best Researchers		(-) No specific policies (+) high attractiveness of Swiss universities
31	Scientific Cooperation with Third Countries		(+) Cooperation with third countries generally differs little from cooperation with partners from the EU. (+) Programs that allow foreign institutions to acquire funding are generally open to both Europe and third countries. (+) The Swiss House for Advanced Research and Education (SHARE or swissnex) has established seats in non-european countries to increase the connectedness of Swiss Science
32	Global Research Infrastructures		(+) Switzerland cooperates in the development and maintenance of some very large scale research infrastructures, the most notable are the European Organization of Nuclear Research CERN (Switzerland / France), the fusion program of Euratom, the European Atomic Energy Community, the European Synchrotron Radiation Facility ESRF in Grenoble (France)
33	National Reform Programs		Not applicable

⁷ http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=eip

Annex 3. National Progress towards realisation of ERA

ERA Priority	ERA Action	Recent changes	Assessment of progress in delivering ERA
1. More effective national research systems	Action 1: Introduce or enhance competitive funding through calls for proposals and institutional assessments	The sustained increase in applications has led to a higher level of competition for a number of years leading to a lower success rate (51% in 2011 vs. 66% in 2008), but it has grown again in 2012 (54% success rate) thanks to fewer proposals and a stable budget. The balance between basic and competitive funding allocated by national public authorities has not changed in recent years; on the other hand, the overall share of competitive allocation has grown due to an increase in funds allocated via international bodies and programs.	(+)Competitive funding has been enshrined in the Swiss research and innovation system for several years: almost all funds targeted at individual persons or private firms are distributed competitively (+ / -)Basic funding of Cantons to HEIs as well as Federal funding to ETHZ and EPFL is not competitive, although it is in part related to the achievement of the goals established in the contracts that regulate the relationships between each public authority and HEI.
	Action 2: Ensure that all public bodies responsible for allocating research funds apply the core principles of international peer review	This principle is well accepted and, as a consequence, no new initiatives or legislative measures have been taken of late.	(+) Both the Swiss National Science Foundation (SNSF) and the Commission for Technology and Innovation (CTI) allocate their competitive funding by submitting projects to a thorough peer review in line with international standard.
2. Optimal transnational co-operation and competition	Action 1: Step up efforts to implement joint research agendas addressing grand challenges, sharing information about activities in agreed priority areas, ensuring that adequate national funding is committed and strategically aligned at European level in these areas	The existing measures have been confirmed and the Message on the promotion of education, research and innovation for 2013-2016 guarantees that adequate funding will be available also for the next programming period.	(+)The Swiss National Science Foundation (SNSF) provides or manages a number of funding opportunities for collaborations within Europe. (+)The new programme phase, SCOPES 2013–2016, has been allocated a budget of 12,5 mil Euro (+)Switzerland participation to ERA-NETs and ERA-NET+ amount to 150 and 26 respectively. The SNSF also manages European Science Foundation (ESF) initiatives such as

			Eurocores and Research Networking Programmes.
	Action 2: Ensure mutual recognition of evaluations that conform to international peer-review standards as a basis for national funding decisions	The Swiss National Science Foundation (SNSF) has signed two Lead Agency Agreements: a trilateral agreement with the German Research Foundation (DFG) and the Austrian Science Fund (FWF) and a bilateral, agreement with the Fonds National de la Recherche du Luxembourg (FNR). These agreements allow researchers from the signatory countries to submit a common proposal to only one of the funding agencies. The other agencies recognise the outcome of the evaluation and, in case of a positive result, fund the project partners in their own country.	
	Action 3: Remove legal and other barriers to the cross-border interoperability of national programs to permit joint financing of actions including cooperation with non-EU countries where relevant	See Action 2	
	Action 4: Confirm financial commitments for the construction and operation of ESFRI, global, national and regional RIs of pan-European interest, particularly when developing national roadmaps and the next SF programs		(+)On the basis of the Swiss Roadmap for Research Infrastructures (SRRI), in the Message on the promotion of education, research and innovation for 2013-2016 the federal government confirmed its financial commitment to the construction and operation of ESFRI, national and regional research infrastructures of pan-European interest.
	Action 5: Remove legal and other barriers to cross-border access to RIs	A referendum has been approved that may limit the circulation of European citizens within the confederation in the coming years.	(+)Research infrastructures are generally accessible to foreigners. Nationals from EU/EFTA States can benefit from the agreement on the free movement of persons. Researchers from all other countries can face

			a minor barrier due to the restrictions to the admission of foreign workers that do not apply, however, in the case of highly qualified workers.
ERA priority 3: An open labour market for researchers	Action 1: Remove legal and other barriers to the application of open, transparent and merit based recruitment of researchers	A referendum has been approved that may limit the circulation of European citizens within the confederation in the coming years.	(+)All universities and most of the other research institutions have signed the Charter for Researchers and the Code on Conduct for the Recruitment of Researchers. Rules concerning academic personnel in Swiss universities make little distinction between Swiss and foreign applicants. (+)Within the framework of the Swiss-EU Bilateral Agreement on Free Movement of Persons, Switzerland has adopted the EU's system of mutual recognition of foreign qualifications issued by EU member states. Third-state nationals are also entitled to apply for recognition of their foreign qualifications in Switzerland.
	Action 2: Remove legal and other barriers which hamper cross-border access to and portability of national grants		(+)As a general rule any scientist affiliated to a Swiss HEI or PRO, regardless of their nationality, can apply for funding from the Swiss National Science Foundation (SNSF). With respect to the portability of grants, the main principle for most European countries is money-follows-the-researcher: researchers who move abroad can ask for ongoing SNSF funding to continue. In some cases, continuation of the project is possible even in countries outside Europe. (-/+)Funding of whole research groups based abroad is generally not allowed, though the Sinergia instrument allows funding of a single research group based outside Switzerland but within a consortium of Swiss-based research groups.

	Action 3: Support implementation of the Declaration of Commitment to provide coordinated personalised information and services to researchers through the pan-European EURAXESS3 network		(+)Switzerland has been active in the EURAXESS initiative since 2008. The Rectors' Conference of the Swiss Universities (CRUS) acts as country coordinator, and adopted a proactive agenda for 2013/20013.
	Action 4: Support the setting up and running of structured innovative doctoral training programs applying the Principles for Innovative Doctoral Training.		(+) The Doctoral Programme (2012/2013-2016), promoted by CRUS supports universities in the creation and development of interuniversity doctoral, while adopting some of the principles for innovative doctoral training
	Action 5: Create an enabling framework for the implementation of the HR Strategy for Researchers incorporating the Charter & Code		(+) Basically all research organisation, universities and universities of applied science have expressed their interest for the implementation of the HR Strategy for Researchers and three of them have currently seen their progress endorsed by the European Commission
ERA priority 4: Gender equality and gender mainstreaming in research	Action 1: Create a legal and policy environment and provide incentives	The Commission for Technology and Innovation (CTI) introduced in 2009 a measure called Diversity@CTI (http://www.kti.admin.ch/org/00199/index.html?lang=en), which focuses on improving guidance of female researchers and entrepreneurs by raising the share of female experts and coaches, by mentoring and networking and by establishing best practices.	(+)The Swiss National Science Foundation (SNSF) commissioned a study on "Gender and Research Funding" (http://www.snf.ch/SiteCollectionDocuments/wom_ber_gefo_synthesis_report_e.pdf). It did not find any gender-specific discrimination in the SNSF's research funding. (-)At the same time, obstacles encountered during the transition from first degree to doctoral study, inadequate career-specific support and difficulties in balancing science and family lead to an over-proportional amount of women leaving the academic system ("leaky pipeline").
	Action 2: Engage in partnerships with funding agencies, research organisations and universities to foster cultural and institutional change on gender	The SNSF joined AcademiaNet (http://www.academia-net.de/) as a partner organisation in 2011. AcademiaNet is an internet portal containing the profiles of outstanding women researchers in	

		German-speaking countries. The database makes it easier to find qualified female scientists to fill management positions and serve as members of scientific bodies.	
	Action 3: Ensure that at least 40% of the under-represented sex participate in committees involved in recruitment/career progression and in establishing and evaluating		(-)There are no generalised measures to establish quotas or minimum requirements to increase the participation of the underrepresented sex. (+)the Swiss Federal Equal Opportunity at Universities Program has been in place for almost 15 years, and support the universities in their work to promote and ensure gender equality. The goal of the Federal Program is to achieve a quota of 25% female professors at Swiss universities, and 40% women at the level of assistant professor. (-)The proportion of women involved in the decision-making panels and in the research funding programmes, bodies of administration, science and science politics suggests the existence of a gender imbalance as regards the apical decision making positions, with a ratio of 4:1
ERA priority 5: Optimal circulation, access to and transfer of scientific knowledge including via digital ERA	Action 1: Define and coordinate their policies on access to and preservation of scientific information		(+)The ARAMIS information system (www.aramis.admin.ch) contains information on research projects and assessments that are either run or funded by the Federal Administration both for the general public and for project managers (restricted).
	Action 2: Ensure that public research contributes to Open Innovation and foster knowledge transfer between public and private sectors through national knowledge transfer strategies	As of 2013, Swiss companies received additional long-term support for innovative activities. National thematic networks (NTNs), innovation mentors (IMs) and physical and web-based plat-forms for Knowledge and Technology Transfer (KTT platforms) have indeed been introduced in 2013.	(+)The Swiss National Science Foundation (SNSF) fosters cooperation among researchers by using it as an evaluation criterion. Furthermore, it provides instruments explicitly requiring cooperation. Most of the budget of the Commission for Technology and Innovation (CTI) is devoted to projects promoting cooperative research.

			(+)The Federal Law on the Promotion of Research and Innovation (FIFG) specifies that research institutions must take care that their research results are available for the public.
	Action 3: Harmonise access and usage policies for research and education-related public e-infrastructures and for associated digital research services enabling consortia of different types of public and private partners		(+) The SWITCH Foundation (SWITCH – Teleinformatics services for education and research), set up in 1987 by representatives of the Swiss Confederation and the cantons deal with optical fibre interconnection of universities, universal login, the digital learning library and applications of e-identity to academia.
	Action 4: Adopt and implement national strategies for electronic identity for researchers giving them transnational access to digital research services		(+)SWITCH implemented, together with its partners (the institutions of the Swiss higher education sector), the authentication and authorization infrastructure (SWITCHaa), which gives its users, using a unique username and password, access to web-based resources across institutions. (+) Concerning the transnational dimension, SWITCH participates to organisations, committees, working parties and research initiatives all over the globe. With respect to the European dimension, SWITCH has close links with DANTE, GEANT, TERENA, FIRST, and CENTR.

REFERENCES

Arvanitis, S., et al. (2005): Wirksamkeit der Projektförderung der Kommission für Technologie und Innovation – Analyse auf der Basis verschiedener Matched- Pairs Methoden, KOF Working Paper, Nr. 103.

Arvanitis S., et al. (2010): ERAWATCH Research Inventory Report for Switzerland, http://erawatchprejrc.es/erawatch/export/sites/default/search/countryprofiles/country_profile_CH.pdf.

Bloomberg (2013) Private Banks Leave Switzerland as End of Secrecy Hurts - Aaron Kirchfeld & Elena Logutenkova -<http://www.bloomberg.com/news/2013-06-30/private-banks-leave-switzerland-as-end-of-secrecy-hurts-profits.html>

Braun, D., & Leresche, J. (2007): Research and technology policy in Switzerland, In Klöti, U., et al., (2007), Handbook of Swiss politics (2nd edition ed., pp. 735-762). Zürich: NZZ Libro.

CTI (2012) CTI activity report 2012 - <http://www.kti.admin.ch/dokumentation/00077/index.html?lang=en>

CRUS (2005) Protokollauszug der Plenarversammlung vom 15./16. September 2005 - Charter for Researchers und Code of Conduct - <http://www.crus.ch/information-programme/euraxess-switzerland/euraxess-rights.html?L=3>

CRUS (2007) Auszug aus dem Protokoll der Plenarsitzung vom 3./4. Mai 2007 - "Charter & Code for Researchers": Labelling Prozess in Europa und der Schweiz

CRUS (2008) Auszug aus dem Protokoll der Plenarsitzung vom 3. Juli 2008 - EU-Programm euraxess-rights: Zuständigkeiten und Aufgaben der "charter&code-Supporter"

EFV - Eidgenössische Finanzverwaltung (2011) State indicators - <http://www.efv.admin.ch/e/>

ERAWATCH Network (2009): Research system analysis report: Switzerland.

ERAWATCH Network (2010): ERAWATCH Country Report 2010: Switzerland.

EUMIDA (2009) European Micro Data – Database on European Higher Education Institutions

European Commission (2007) Remuneration of researchers in the public and private sector http://ec.europa.eu/euraxess/pdf/research_policies/final_report.pdf

European Commission (2011): Innovation Union Competitiveness report, http://ec.europa.eu/research/innovationunion/index_en.cfm?pg=home§ion=competitiveness-report&year=2011.

European Commission (2012): Innovation Union Scoreboard 2011 – The Innovation Union's performance scoreboard for Research and Innovation, http://ec.europa.eu/enterprise/policies/innovation/files/ius/ius-2010_en.pdf.

European Commission (2013) Research and Innovation performance in EU Member States and Associated countries - Innovation Union progress at country level

EUROSTAT (2008) Research and development expenditure, by sectors of performance
<http://epp.eurostat.ec.europa.eu/tgm/refreshTableAction.do;sessionId=9ea7d07d30dfcd937979db194fab8874a9f1e2b63ef6.e34MbxSc40LbNiMbxNaNaNe0?tab=table&plugin=1&pcode=tsc00001&language=en>

EVD and SECO (2012) Venture Capital in Switzerland, Bern, June 2012

FDEA and OPET (2012) Federal and Cantonal Funding in the Education, Research and Innovation Sector 2004–2016, Bern, December 2012
<http://www.sbf.admin.ch/org/01645/index.html?lang=en>

Federal Council (2007): Botschaft über die Förderung von Bildung, Forschung und Innovation in den Jahren 2008-2011, Bern.

Federal Council (2010): Botschaft über die Förderung von Bildung, Forschung und Innovation im Jahr 2012, Bern.

Federal Council (2012a): Botschaft über die Förderung von Bildung, Forschung und Innovation in den Jahren 2013-2016, Bern.

Federal Council (2012b): Botschaft über die Legislaturplanung 2011-2015, Bern.

FSO (2012a): Science and Technology – Indicators – R&E expenditures,
<http://www.bfs.admin.ch/bfs/portal/de/index/themen/15/09/key/ind2.indicator.20202.202.html>.

FSO (2012b): Tertiary education – Indicators – Finances,
<http://www.bfs.admin.ch/bfs/portal/de/index/themen/15/06/data/blank/04.html>.

FSO (2012c) Public Funding of Research in Switzerland 2000–2010, Neuchatel September 2012

FSO (2013) R&D: Expenditure and personnel of the Swiss business enterprise sector 2012, Press release January 2013

KPMG (2011) Tax Incentives for R&D in Switzerland
http://www.amcham.ch/publications/downloads/20110824_kpmg_amcham_study_en.pdf

Leiden University (2012), Leiden Ranking 2011/2012,
<http://www.leidenranking.com/ranking.aspx>

Lepori, B. (2007b): La politique de la recherche en Suisse. Institutions, acteurs et dynamique historique. Bern.

Lepori, B. (2009): ERAWATCH Country Report 2009 - Analysis of policy mixes to foster R&D investment and to contribute to the ERA – Switzerland

Lepori, B. (2011): Joint and Open REsearch Programs - National report on joint and open programs – Switzerland

OECD (2006): OECD Reviews of Innovation Policy – Switzerland, OECD: Paris

OECD (2008) The Global Competition for Talent - MOBILITY OF THE HIGHLY SKILLED

OECD (2011): OECD Science, Technology and Industry Scoreboard 2011, http://www.oecd.org/document/10/0,3746,en_2649_33703_39493962_1_1_1_1,00.html.

OECD (2012): Education at a Glance 2012, OECD: Paris
State Secretariat for Education and Research (2008): Switzerland's Participation in the 6th European Research Framework Programme, http://www.sbf.admin.ch/htm/dokumentation/publikationen/international/frp/6frp/6FRP_en.pdf.

SBFI (2012) Botschaft über die Förderung von Bildung, Forschung und Innovation in den Jahren 2013–2016 - <http://www.admin.ch/opc/de/federal-gazette/2012/3099.pdf>

SECO, ARE (2011) “The federal government's regional policy” State Secretariat for Economic Affairs SECO, Regional and Spatial Planning Policy, Federal Office for Spatial Development ARE

SECO (2012) Venture Capital in Switzerland, Bern, June 2012

Seeber M., Lepori B. (2014) The Internationalization of European Higher Education Institutions, in “The European higher education landscape, Diversity and performance” Edited by Andrea Bonaccorsi, Edward Elgar

SER (2011) Swiss Roadmap for Research Infrastructures

SERI (2011a): Bibliometrische Untersuchung zur Forschung in der Schweiz 1981-2009, http://www.sbf.admin.ch/dokumentation/00335/01740/index.html?download=NHZLpZeg7t,lnp6I0NTU042l2Z6ln1acy4Zn4Z2qZpnO2Yuq2Z6gpJCDfIR8gWym162epYbg2c_JjKbNoKSn6A--&lang=de

SERI (2011b): Stand und Perspektiven Energieforschung – Bericht der Arbeitsgruppe Forschung (AG Energieforschung) im Rahmen IDA Energie, http://www.sbf.admin.ch/htm/dokumentation/publikationen/forschung/11.06.06.NFO.StandPerspektivenEnergieforschung_d.pdf

SERI (2012) Swiss Participation in 7th FP program 2007-2012 period – interim report - <http://www.sbf.admin.ch/themen/01370/01683/index.html?lang=en>

SERI (2013) Higher Education and Research in Switzerland, www.sbf.admin.ch/campus-switzerland-e.html

SNB – Swiss National Bank (2013) External Sector: Balance of payments (quarterly) - http://www.snb.ch/ext/stats/imfsdds/xls/en/imfsdds_S1_D1_M4.xls

SNF (2010) SNF Research funding in figures 2010 - http://www.snf.ch/SiteCollectionDocuments/por_fac_sta_kurz_jb10_e.pdf

SNF (2012) SNF Research funding in figures 2012 - http://www.snf.ch/SiteCollectionDocuments/por_fac_sta_kurz_jb12_e.pdf

Shanghai Jiao Tong University (2012): Academic Ranking of World Universities, <http://www.arwu.org>

Swissinfo.ch (2012a) Thriving housing market threatens debt trap - by Matthew Allen- http://www.swissinfo.ch/eng/swiss_news/Thriving_housing_market_threatens_debt_trap.html?cid=32328164

Swissinfo.ch (2012b) Economic slump helps firms innovate - by Samuel Jaberg - http://www.swissinfo.ch/eng/specials/swiss_franc/Economic_slump_helps_firms_innovate.html?cid=32144104

Thomson Reuters (2012): Times Higher Education Ranking 2011-2012, <http://www.timeshighereducation.co.uk/world-university-rankings/2011-2012/top-400.html>.

TrendChart (2009): INNO-policy TrendChart – Innovation Policy Progress Report: Switzerland 2009.

US treasury (2013) Treasury, Switzerland Sign Bilateral Agreement to Improve Tax Compliance, Combat International Tax Evasion and Implement FATCA - <http://www.treasury.gov/press-center/press-releases/Pages/tg1853.aspx>

LIST OF ABBREVIATIONS

BERD Business Expenditures for Research and Development
CERN European Organisation for Nuclear Research
CIESM The Mediterranean Science Commission
COST European Cooperation in Science and Technology
CRUS Conference of Rectors of Swiss Universities
CSCS Swiss National Supercomputing Centre
CTI Commission for Technology and Innovation
DFG Deutsche Forschungsgemeinschaft
EAER Federal Department of Economic Affairs, Education and Research
EAWAG Swiss Federal Institute of Aquatic Science and Technology
EDI Federal Department of Home Affairs
EMB European Marine Board
EMPA Swiss Federal Laboratories for Materials Science
EPFL Federal Institute of Technology Lausanne
ERA European Research Area
ERA-NET European Research Area Network
ERI Education, Research and Innovation
ERIC European Research Infrastructure Consortium
ERP Fund European Recovery Programme Fund
ESA European Space Agency
ESF European Science Foundation
ESFRI European Strategy Forum on Research Infrastructures
ESO European Southern Observatory
ESRF European Synchrotron Radiation Facility
ETH Federal Institute of Technology
ETHZ Federal Institute of Technology Zurich
EU European Union
EU-27 European Union including 27 Member States
EUREKA Europe-wide Network for Market-Oriented Industrial Research
EVD Federal Department of Economic Affairs
FDFA Federal Department of Foreign Affairs
FDI Foreign Direct Investments
FIFG Federal Law on the Promotion of Research and Innovation
FIT Federal Institute of Technology
FORS Swiss Center of Expertise in the Social Sciences
FP Framework Programme
FP7 7th Framework Programme
FSO Federal Statistical Office
FWF Fonds zur Förderung der wissenschaftlichen Forschung
GBAORD Government Budget Appropriations or Outlays on R&D
GDP Gross Domestic Product
GERD Gross Domestic Expenditure on R&D
GOVERD Government Intramural Expenditure on R&D
GUF General University Funds
HEI Higher education institutions
HERD Higher Education Expenditure on R&D
HES Higher education sector
HFSP Human Frontier Science Program

ILL Institut Laue-Langevin

IP Intellectual Property

JTI Joint Technology Initiatives

NCCR National Centre of Competence in Research

NRP National Research Programme

OAQ Swiss Centre of Accreditation and Quality Assurance in Higher Education

OECD Organisation for Economic Co-operation and Development

OPET Federal Office for Professional Education and Technology

PRO Public Research Organisations

PSI Paul Scherrer Institute

R&D Research and Development

RDI Research Development and Innovation

RI Research Infrastructures

RTDI Research, Technological Development and Innovation

S&T Science and technology

SER State Secretariat for Education and Research

SERI State Secretariat for Education, Research and Innovation

SF Structural Funds

SIB Swiss Institute for Bioinformatics

SME Small and Medium Sized Enterprise

SNSF Swiss National Science Foundation

SRRI Swiss Roadmap for Research Infrastructures

SSTC Swiss Science and Technology Council

SUC Swiss University Conference

THE Times Higher Education

UAS University of Applied Sciences

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